Rochester Institute of Technology
RIT Scholar Works

Theses | Thesis/Dissertation Collections

11-5-2012

Cinch furniture system

Betsy Barnhart

Follow this and additional works at: http://scholarworks.rit.edu/theses

Recommended Citation
Barnhart, Betsy, "Cinch furniture system" (2012). Thesis. Rochester Institute of Technology. Accessed from

This Thesis is brought to you for free and open access by the Thesis/Dissertation Collections at RIT Scholar Works. It has been accepted for inclusion in Theses by an authorized administrator of RIT Scholar Works. For more information, please contact ritscholarworks@rit.edu.

R·I·T

Cinch Furniture System

By

Betsy Barnhart

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Fine Arts in Industrial Design

School of Design
College of Imaging Arts and Sciences
Rochester Institute of Technology
Rochester, NY

November 5th, 2012

COMMITTEE MEMBERS

Stan Rickel
Associate Professor, Graduate Coordinator
Chief Advisor

Lorrie Frear
Associate Professor
Associate Advisor

Contents

Abstract

This thesis explores solutions to the problem young adults face when relocating on a budget. The target age range of 20 to 30 year-olds face multiple hurdles when it comes to their nomadic existence. On average this age group relocates once per year; they are a consumerist population often defining themselves by their possessions; and are often under tight budget constraints. Since nomadic cultures to the current day, relocation has allowed individuals access to better things and the essentials of life. The difference being that nomadic cultures had fewer possessions which were designed for easy packing and carrying, where as current young professionals have far more possessions, most of which are designed for a sedentary lifestyle. The goal of the thesis is to create a design solution which makes moving faster, less complicated, more affordable, stylish and appealing to young adults.

Commentary

My initial thesis was a system for moving from one living space to another. The system would consider the needs of young adults on a budget who often move long distances and in compact spaces. The goal was to enable young adults the freedom to relocate without stress and also to be able to be proud of their dwelling and mobile lifestyle.

During my initial research and analysis I came to the conclusion that my research subject was overly broad and did not fulfil my objective. I realized that furniture systems, rather than mobile housing systems supported a real need for versatility within different living systems.

This documents my thesis process from choosing a design problem, focusing my work, creating a working design solution, and developing a strategy for manufacturing.

Thesis Statement

Background

In the United States over one third (37 percent) of persons 20 to 24 years old moved in 2002 and 2003. This rate is twice the annual rate found for all persons one year old and over (16.8 percent). Persons 25 to 29 years old have nearly as high a rate of moving as persons in their early twenties; 30.9 percent moved in the previous year. Moving rates continue to decline as age increases to an apparent low of 5.3 percent for persons 75 to 84 years old. There appears to be a slight upturn in moving rates for persons at the oldest ages due to assisted living needs; persons 85 years old and over had a moving rate of 6.1 percent. The high rate at which young people move show that there is a demand within this population for furnishings which are stylish and affordable. These demands have been met, most notably by Ikea.

Problem

There is one need which has not been met. Persons between 20-30 years old often move long distances on tight budgets, making it necessary to have a system to aid in moving their belongings in compact spaces. Current furniture is not easy to assemble and break down, adding a lot of time and hassle to the moving process. The youth of today expect their belongings to be stylish, affordable and easy to move. This market has not been fully addressed.

Proposal

This thesis will study the needs of young adults who often move long distances, taking into consideration the need for a system allowing them to move affordably in a compact space.

Goal

This thesis will develop a system based on the conclusion of my research on the living and moving needs of young adults ranging in age from 20 to 30 years old. I will study the advantages and disadvantages of available systems targeting this market, to find the best solution. Concepts for systems addressing these needs will be developed for mass production.

Methodology

The methodology for my thesis will include intensive research on technology, existing products and systems related to its mobility and ability to be compacted. I will also conduct interviews with potential users and product specialists. The research materials will be organized in a format in which information is clear, narrowed down, and easily located. I will also create concept ideations on forms and structures (involving sketches, models, and renderings), as well as design development and refinement, prototypes, field test, user feedback, and final design, and create a coherent presentation and paper of my design processes and final system design.

Statement Synthesis

After my thesis statement was written and approved by my thesis committee it was time to start researching and determining possible routes for viable solutions. When I began I realized I needed to narrow my focus in order to create a design solution which would best meet the needs of my demographic. There were two thesis directions which needed to be explored. The two thesis directions are as follows:

Direction 1

Moving often creates a lack of personal comfort through stability and familiarity of space due to having to find a new location and structure to live in, pack belongings, relocate, and unpack into a new space.

Direction 2

Because young adults move so often they are relocating long distances only with their vehicle and often without help of others in the new location, furniture and belongings must be broken down, sold, or collapsed in order to move which makes moving complicated and stressful.

Both of these directions solve my thesis in different ways, it was time to research the problems urban nomads face and the different design solutions previously used to solve the issue of a sense of mobile permanence in terms of shelter and in terms of material goods and furnishings.

Background Research

Domiciles have evolved over human history from the shelters of hunter gatherers, to permanent residential dwellings in a town or city. Due to the high cost barrier to home ownership and the demand on young professionals to relocate for employment opportunities, there has been a shift back towards a type of urban nomadic lifestyle in recent years. Throughout the current shift towards urban nomadism, the pressures of a consumer lifestyle where possessions are often a defining feature of an individual, have clashed with the needs of their budget and ability to transport their belongings.

According to a Pew research study, among U.S. born adults who have lived in more than one community, nearly four-in-ten say the place they consider home isn't where they're living now. Around 56% of 18-29 year-olds move at least once, increasing to 77% with education and residence in a city (Pew Research Center). The demands this transient demographic faces are an increased cost per square foot of residential rentals, and an increased likely hood of being in a non family household.

With such a high prevalence of relocation for this demographic, the challenges of moving must be met. First of all, 54% of New York City households and 30.3% of households in San Francisco (San Francisco Municipal Transportation Agency), don't own cars. Of those who do have cars, the average cargo volume is 35.5 cu. ft (consumerreports.org). The average towing capacity for a car is 1500 lbs (auto.howstuffworks.com). The average weight of a one bedroom apartment's contents is 3,500 lbs. The cost of using a professional moving company to move 750 miles with an average one bedroom apartment's worth of belongings (U.S. Census Bureau) is an estimated $2,281 (movesource.com). Average income for non-family households between 20 and 30 years of age is $29,730. There is a clear need to develop creative ways to bring flexible, compact, cost effective, options which can travel with an individual.

Despite the limitations of space and finances facing many young professionals, this

period of time is when many define themselves through the acquisition of possessions. The suggestion that possessions play a large roll in defining ones self was first written about by Sartre (1943) and supported by Belk in 1988. As Belk suggests: ". . . the only reason we want to have something is to enlarge our sense of self and that the only way we can know who we are is by observing what we have. In other words, having and being are distinct but inseparable. When an object becomes a possession, what were once self and not-self are synthesized and having and being merge. Thus, according to Sartre, possessions are all important to knowing who we are. People seek, express, confirm, and ascertain a sense of being through what they have (pp. 145 – 146)." In short, we are what we have (Wright, Clairborn, and Sirgy 311 – 318). In an age where consumers are used to cheap goods with a short shelf life, the challenge is to make a durable product which the purchaser is proud of and sees as an extension of themselves or even a badge of honor.

Problem Focused

When young college graduates enter the workforce, they join a demographic with a high likelihood of moving at least once a year within their current city, or once every five years to a new city. In psychological terms, each transition, or move, can be broken down into four phases (Pederson):

Honeymoon—This is the first weeks in a new location. When young professionals first set up their new dwelling there is a sense of romantic idealism. The newness of the surroundings spur an optimistic outlook for the life that is possible. At this stage, they will make choices in furniture and belongings to define who they are and how they wish others to see them. This self-definition can be articulated through various methods. Young professionals may be purchasing a look, building their own surroundings, or simply finding objects to fill the void that will be discarded later on.

Negotiation—This is when young professionals begins to feel anxiety and loneliness. It has been a month or so since they moved to a new location and the strain of losing old friends and a new environment are taking a toll. The differences between the old and the new and the often unfulfilled expectations begin to create frustration and unpleasant feelings of anxiety.

Adjustment—At this point, routines have developed and relationships have started to take root and become deeper. Five to six months have passed and this is a stage where most feel comfortable because they have established themselves at work and in their living arrangements. What was once new and strange is no longer frustrating but is now normal.

Mastery—The young professionals have fully acclimated to their new surroundings. Friendships and relationships have formed which are grounding and make them feel like part of the fabric of the community. It is during this phase that most young professionals will look to new products or opportunities to enhance their self image.

Urban nomads, or young professionals, are generally college graduates who move from

city to city working for relatively short periods of time, from 2 months to 5 years. They are usually between the ages of 20 to 30 years old as they have the most flexibility in their lives, the distances they are moving may be within the same city due to insecure housing or from one side of the country to another.

These urban nomads will learn during the process of moving and acclimation that their belongings and type of dwellings will ease their moving process or cause challenges. During a move, large bulky furniture may or may not fit into their car (if they have one), and after they get it to the new location the furniture may not fit into the new dwelling.

In order to remove some of the anxiety and frustration, the movers will use various strategies to minimize changes. These strategies include but are not limited to relocating a mobile dwelling, using the same furniture to create a sense of continuity, or reconfiguring existing materials in a do-it-yourself approach. The former is ideal if space to park a mobile unit is available, or if there isn't legislation or zoning prohibiting it. Therefore, the likelihood of successfully relocating to various urban localities with a mobile dwelling is low, with a much higher likely hood of building personal identity through the acquisition of interior possessions.

Often this demographic is on a tighter budget than older counterparts. This means this population faces challenges in moving often, without help from others, and with limited resources. This situation makes this demographic a target for low investment furniture and belongings. The flat packed furniture can be deconstructed and is usually at more affordable prices. Often the flat packed furniture is difficult to assemble and disassemble and is moved in its built form to avoid the hassle.

Analysis

There are many attempts to design a solution for our present day transient needs. There are two systems most commonly used: mobile living solutions and interior solutions through transportable, space saving, or multi-use solutions. These solutions have had some success in meeting the needs of transient people but do not reflect all of the needs of the urban nomad.

They can be further broken down into the following subcategories:

Mobile living solutions
- Mobile homes
- Recreational vehicles
- Shipping containers
- Floating homes
- Tent structures

Interior solutions
- Apartment in a box
- Dynamic function
- Collapsible systems
- Modular
- Do-It-Yourself (D.I.Y.)
- Flat pack

Mobile Living Solutions

There are many design solutions which attempt to solve transient living in creating a form of shelter designed people to sleep in. These solutions range from mobile homes which look like permanent site built homes to a basic tarp/pole tent.

The mobile shelter solution can offer the most consistency of living because the living space remains the same even if it is broken down and set up between moves. This system allows the user to have the reassurance that they will have a sheltered place to call home, the obstacle with mobile shelter solutions is finding a space to set up or park their home. There are two different scenarios for mobile shelter, one allows the person to move their home and not have to pack up their belongings or at least store their belongings inside of the living area if it is collapsed down, many of these options also give the individual the option of hooking up to basic utilities and sewage giving the feeling of permanence.

The other scenario is transportable living options that collapse down to a point where belongings cannot be stowed inside of the living unit during transport, this makes the living unit more transportable by itself but requires people to have another solution for moving their belongings and keeping their belongings together and organized.

Mobile Homes

Mobile homes are prefabricated structures that are initially built to be towed to a semi-permanent location. They are designed to include home or office necessities, which may include a bathroom, kitchen, and sleeping areas, all fitting within the size restrictions of a semi-truck trailer. Mobile homes vary in size by adding multiple trailers together, forming double or triple wide mobile homes when combined. The mobile home is built with a trailer hitch and a chassis including axles and wheels, however, once the home is in place the wheels are often removed and the trailer is placed on a permanent structure, negating the mobility of the mobile home.

Advantages

- Readily available
- Can act as a site built home with full hookups to water, sewage, and electric
- Cheaper than purchasing site built home
- Transportable
- Come in a variety of sizes
- Fully finished interior and exterior similar to site built home

Disadvantages

- A truck must be used to move the house
- Only a single wide can move intact
- Most never move again

Recreational Vehicles, Trailers and Campers

These are vehicles or tow behind trailers which can include living space including a kitchen, bathroom, bedroom, and living room. They are intended for leisure or for full time living in trailer parks. Another use for them is as a mobile office.

Recreational Vehicle Types

RV—Ride and live combined, these can be very large
Camper Van—a smaller version of RV, can integrate into everyday
Travel Trailer—towed behind a truck
Hybrid Trailer—travel trailer with a folding tent
Park Model—standard travel trailer not self contained and needs hookups
Folding Trailer—pop-up or tent camper that collapses for towing
Teardrop Trailer—compact lightweight travel trailer usually for motorcycles

Advantages

- Very mobile way to live, home is on the road
- Belongings are in one space
- Cheaper than purchasing site built home
- Come in a variety of sizes and options

Disadvantages

- Low fuel economy
- Some RVs can be expensive when compared to trailers
- To park long term you often need a permit or designated campsite

Shipping Containers

Modular re-purposed shipping containers which are used for individual homes or as parts of larger structures.

Advantages

- Strength and durability
- Modular, can be stacked or interlocked
- Transported by ship, truck, or rail as it was originally made for shipping
- Widely available
- Low cost compared to other finished structures

Disadvantages

- Temperature, needs insulation as it is not meant for habitation
- Could have residue from whatever cargo it was carrying previously
- Can not relocate home on own, must have someone move by truck, ship, or rail

Floating Homes

There are different styles of floating homes from houseboats to sailboats and yachts. Houseboats are kept tethered to land so they can have an address and utilities, the interiors of houseboats tend to be similar to the interior of land built homes. Sailboats and yachts that are transformed into living vessels can be moored in live-aboard marinas and have access to public rest rooms, showers, electricity, and water. The interiors of live-aboard sailboats which are still used for recreational sailing must have solutions to keep belongings stowed and dry in a limited space. Often these boats have multi-use furniture which can also collapse when are not in use for maximum space efficiency.

Advantages

- Mixes housing and pleasure
- More affordable than waterfront property
- Can be up to 2,000 sq. ft. with all the amenities

Disadvantages

- Needs to be moored in a protective area, cost can be high
- Not all locations support houseboats
- Not all houseboats can be relocated easily
- Interior of sailboats in the ocean get salty when sailed- belongings must be stowed and protected

Tents

Tents were first used by nomads because they are so easy to move, but now are usually used for temporary shelter or for camping. Tents are available in many sizes, from a one person design meant to be carried in a hikers backpack to a circus tent. A tent is consists of a material draped over a frame or attached to a supporting rope.

There are many types of tents, but there are two types for sheltered sleep:
The first tent types are the smallest and lightest types of tents for carrying long distances in a backpack, bike, boat, or small vehicle. These are not made to shelter a lot of people, but are very easy to set up and take down.

The second tent types are tents meant to be carried in a vehicle, often these are used for disaster situations or by the military as temporary housing. These tents can be very basic but also can have all of the amenities that a home could have, including air-conditioning, heat, electricity, and full kitchens.

Advantages

- Low environmental impact
- Economical, can be as simple as a structural pole, canvas, guide line and stakes
- Most portable housing option available
- Many options available for any use for the most comfort

Disadvantages

- Must find locations suitable for camping which allow camping
- Difficult to camp in urban areas
- Direct interaction with the environment, weather etc.
- Disaster relief tents can often lead to permanent shantytowns

Interior Design Solutions

Mobile shelter offers the permanence of a place to rest ones head, but when moving from one urban area to another often it is easier to find living spaces which already exist than having ones possessions move ready in a moments notice. Another issue commonly faced by this demographic is that living spaces tend to be small so belongings and furniture need to work well with the space. Interior solutions include: apartment in a box, multi-function, collapsible systems, modular, Do-It-Yourself (D.I.Y.), and flat pack.

Apartment in a box

This is an interior solution where a movable box either unfolds or comes apart and contains all, or most of the necessities of modern apartment living. They can contain all of the furniture a person needs, a bookcase, bed, chairs, desk, kitchen, and office. Or they can unfold to create a seeming division of space for work, sleep, kitchen, and lounging. These solutions have been more on the art side.

Advantages

- Some solutions can be moved by one or two people
- All furniture can be moved in one compact box
- Creates a consistent environment in any location
- Moving costs are lower because belongings are nested together

Disadvantages

- There is not a readily available mass market solution
- Many solutions have an air of not being permanent
- Some solutions are very heavy to move
- Construction not rugged and often an interpretation of furniture, lacking comfort

Multi-function

Multi-function systems range from a dual use chair that unfolds and becomes a ladder, to furniture systems which can be used to create furniture to fit in any space. This reduces the amount of possessions needed and allows for a changing home environment without new purchases.

Advantages

- Save space by having 2 or more uses for 1 object
- Flexibility in use

Disadvantages

- Cost prohibitive
- Multi-function rarely used, once its a ladder it stays as a ladder
- Difficult to make both functions work well

Modular

Modular systems are designed with standardized units which can be combined in different ways because they have smaller interchangeable parts. It is designed for easy assembly and flexibility in use. This system can have new additions to previous designs by plugging in a new module. Modular design can combine the benefits of standardization and also have custom elements added to it. The ability to have many configurations makes it an adaptable solution to new spaces and needs.

Advantages

- Customizable for individuals needs
- Can be a single function system or multi-function system
- Can stay on trend by updating elements as needed

Disadvantages

- Joints and connection points become worn out over time
- Can be cumbersome and difficult to put together, parts can be lost when moving
- If a part no longer in production can affect use of whole system

Collapsible Systems

Collapsible systems must be designed to be reused more than one time and can expand, contract, or have multiple objects nest together to save space when not in use. Ideally, objects which are collapsible should be too large in its expanded state for storage, or too unwieldy for transporting. This method has been used since people began rolling up rugs to sleep on as well as designing collapsible tents to sleep under. These systems include: stress, folding, creasing, bellows, assembling, hinging, rolling, sliding, inflation, fanning, and concertina (Mollerup).

Advantages

- Solutions can have no hardware to lose, and are self contained
- Collapsed profile is easier for storage and ships cheaply
- Often applies a one step construction method

Disadvantages

- Needs durable materials that can withstand repeated stresses, which adds to costs
- Hinges, fabric, or other materials may wear out from use
- Inflation or stress based systems can warp or lose structural integrity over time.

Flat Pack

Flat pack includes self assembly and knock down furniture and is not intentionally collapsible, it is delivered not fully manufactured and usually is built and never disassembled again, which is why it is not a collapsible system. Flat pack was created to save costs for the distributor as it does not require full manufacturing time and saves on shipping costs. IKEA is a flat pack retailer and helped propel an industry based on cost savings through self assembly. Self-assembly furniture is not collapsed when delivered; it is just not yet fully manufactured.

Advantages

- Costs are lower than fully built furniture
- Most furniture can fit into a station wagon when purchased

Disadvantages

- Assembly is not always simple and can be time consuming
- Flat-pack is not designed to be disassembled

Do-It-Yourself (D.I.Y.)

Do it Yourself solutions can range from kits which can be purchased on the internet for complicated antique styled furniture, to designs meant to be used with found materials or free materials such as using fed-ex packages to create bed frames, desks and any other furniture imaginable.

Advantages

- Prices vary from free to as expensive as the person building it wants it to be
- If time to rebuild and find materials is not an issue the object or furniture can be left behind when moving as it is not expensive or materials were free.
- Can have personality of the person building it brought in through materials or final styling

Disadvantages

- Time consuming
- Can feel impermanent
- May not be comfortable
- Not necessarily durable
- Individual must have some skill and building capabilities

Refocused Thesis Statement

The goal of this thesis will be to design a system that will allow an urban nomad to move from one location to another with ease. The system will showcase its mobile abilities and will enable the user to relocate efficiently through minimum hassle in packing, unpacking, and moving.

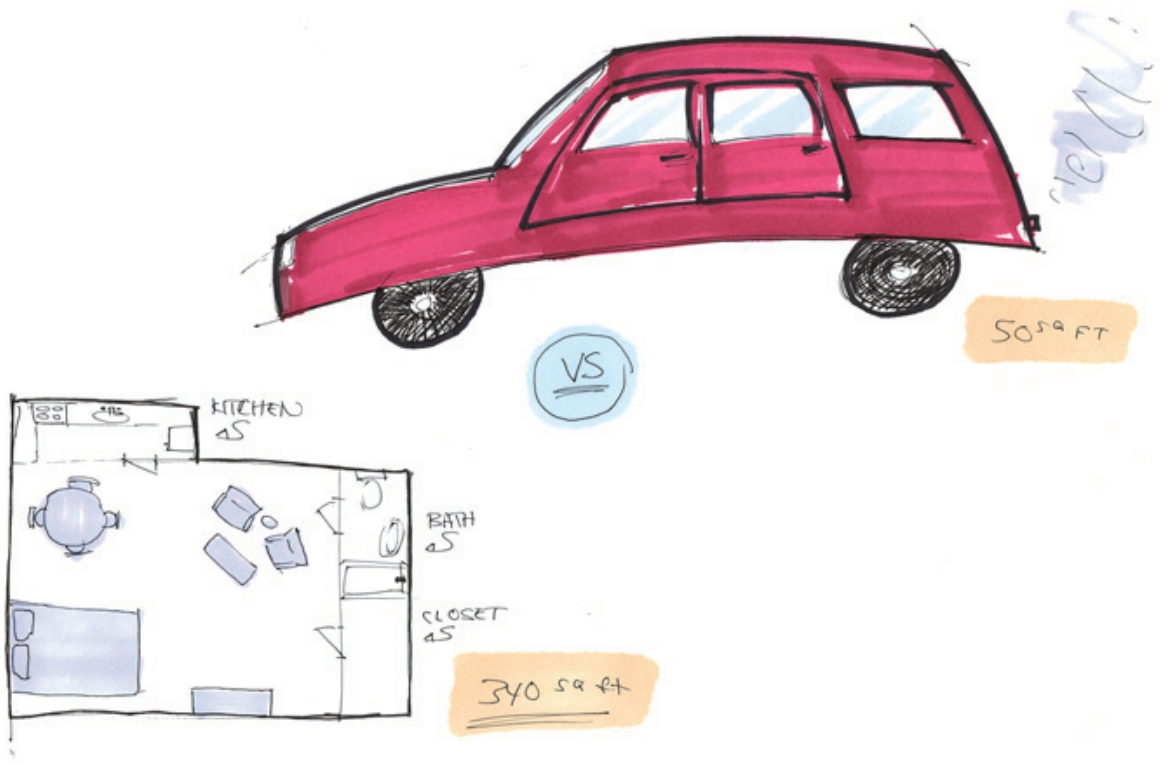
Because relocating one's possessions is time consuming and can be costly this thesis will focus on interior solutions rather than a mobile shelter system. This will maximize the users flexibility in finding appropriate existing shelter in whatever location they may be relocating to and will give them the ability to move their belongings with less hassle.

There are multiple avenues for this thesis to explore in finding an interior solution. These range from solutions which store other possessions the user may have, creating furniture which reduces the quantity of furniture the user needs by having multiple uses, to furniture which collapses or breaks down in a way that makes relocating a simpler and more pleasant experience.

Preliminary Ideation

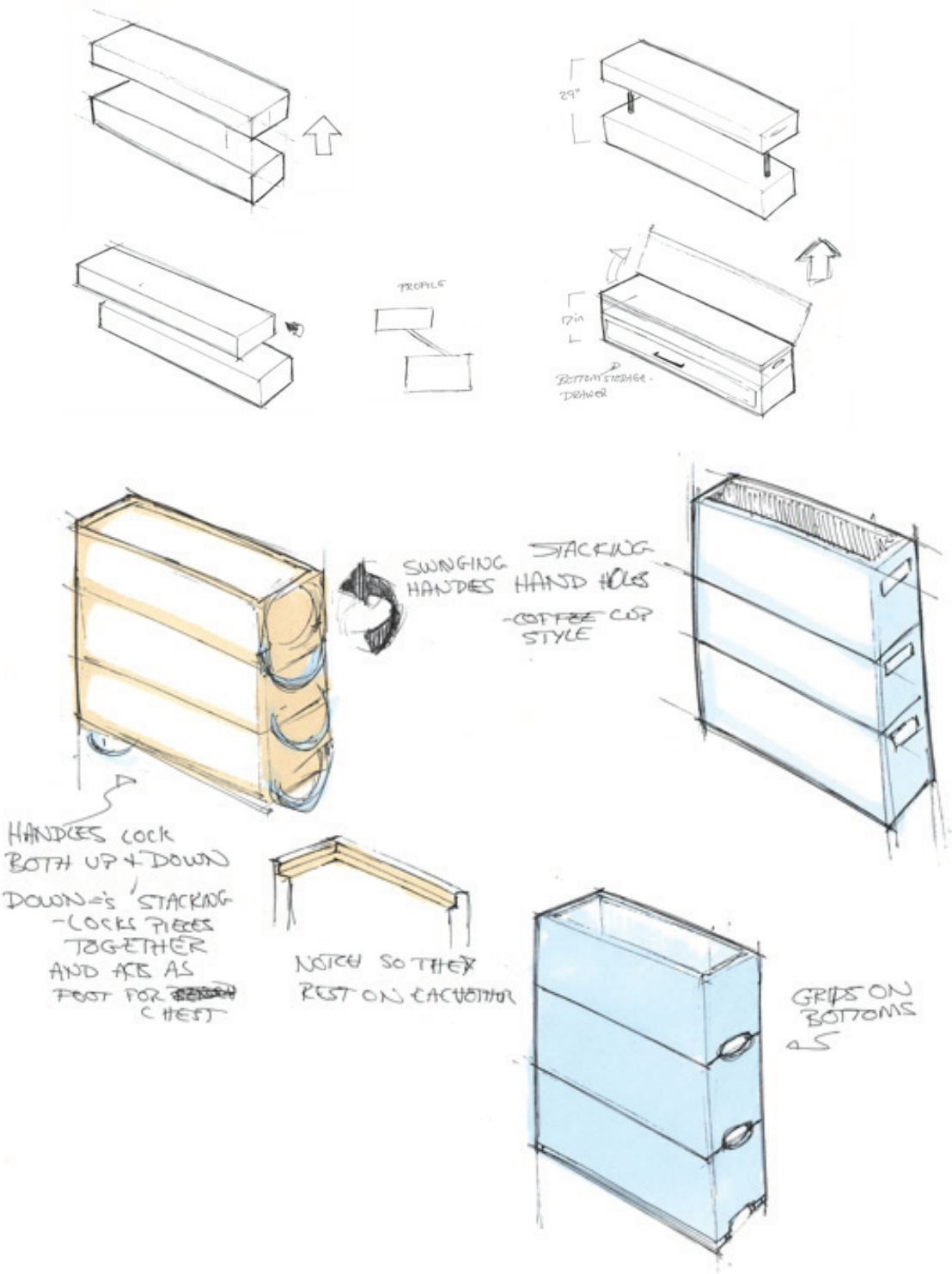
Systems that anticipate the needs of urban nomads

- Minimal moving space
- Living in a small space



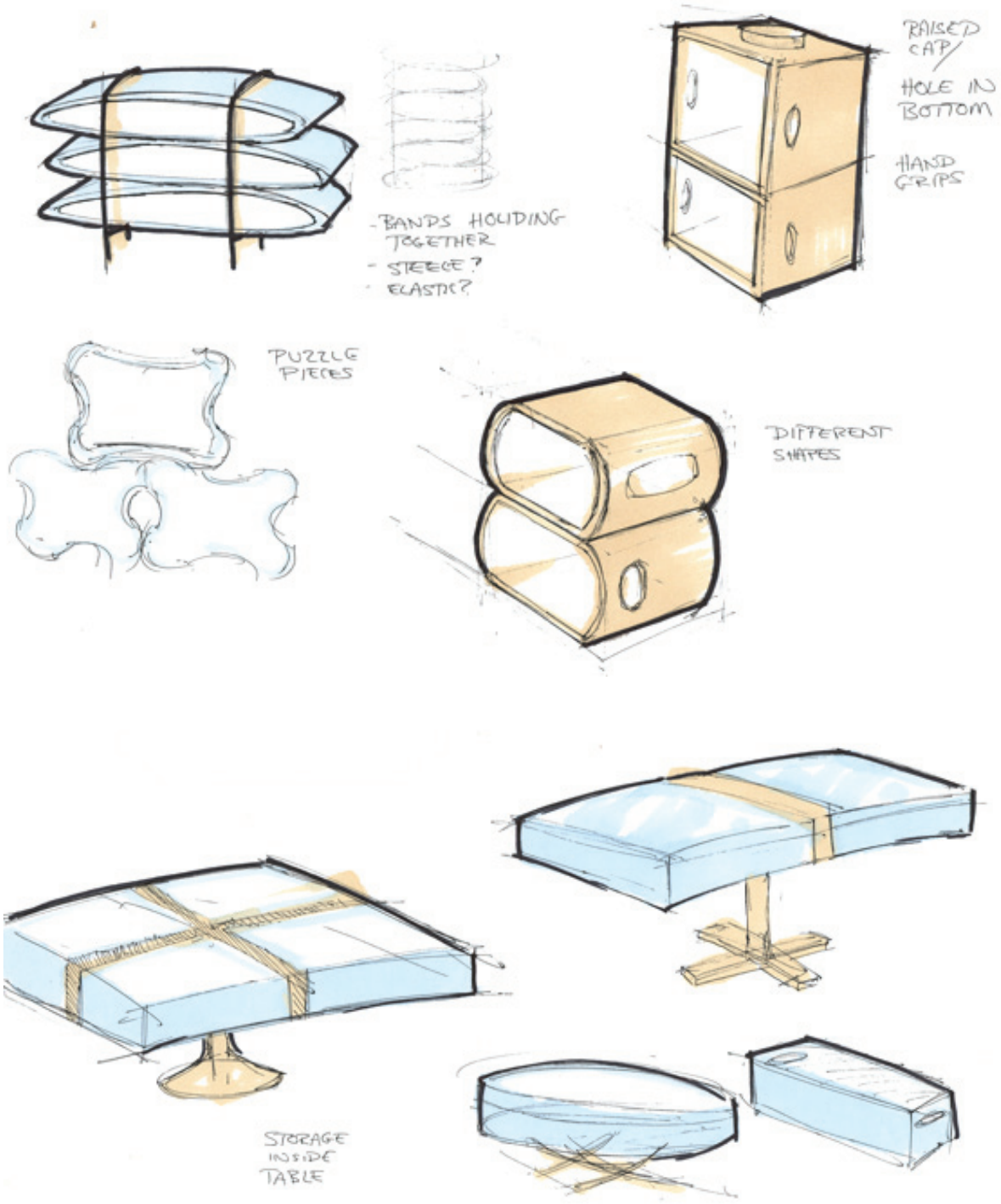
Ideation: Storage in furniture sketches

- Expandable units
- Modular units



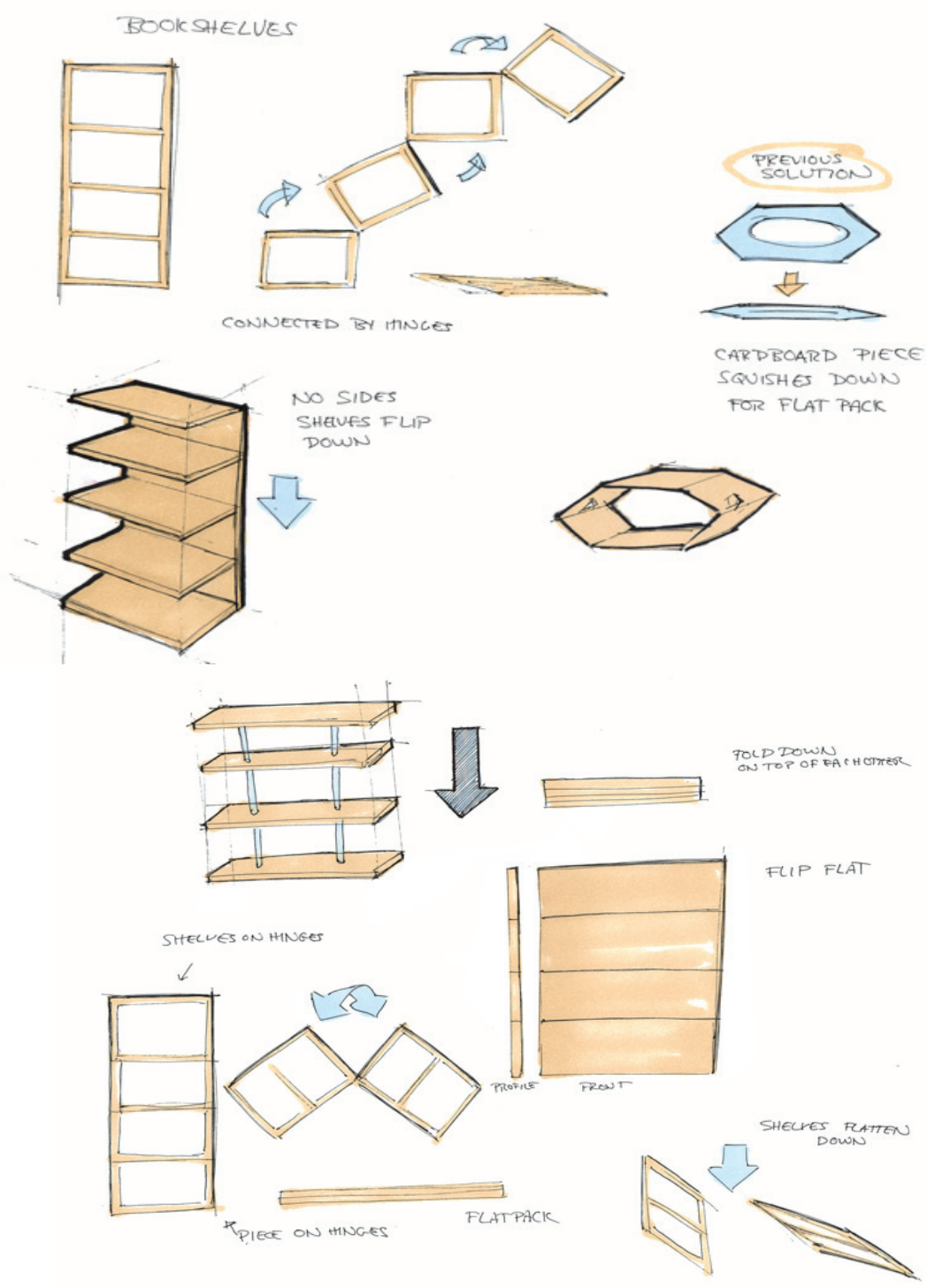
Ideation: Systems utilizing storage sketches

- Modular units
- Storage integrated in furniture



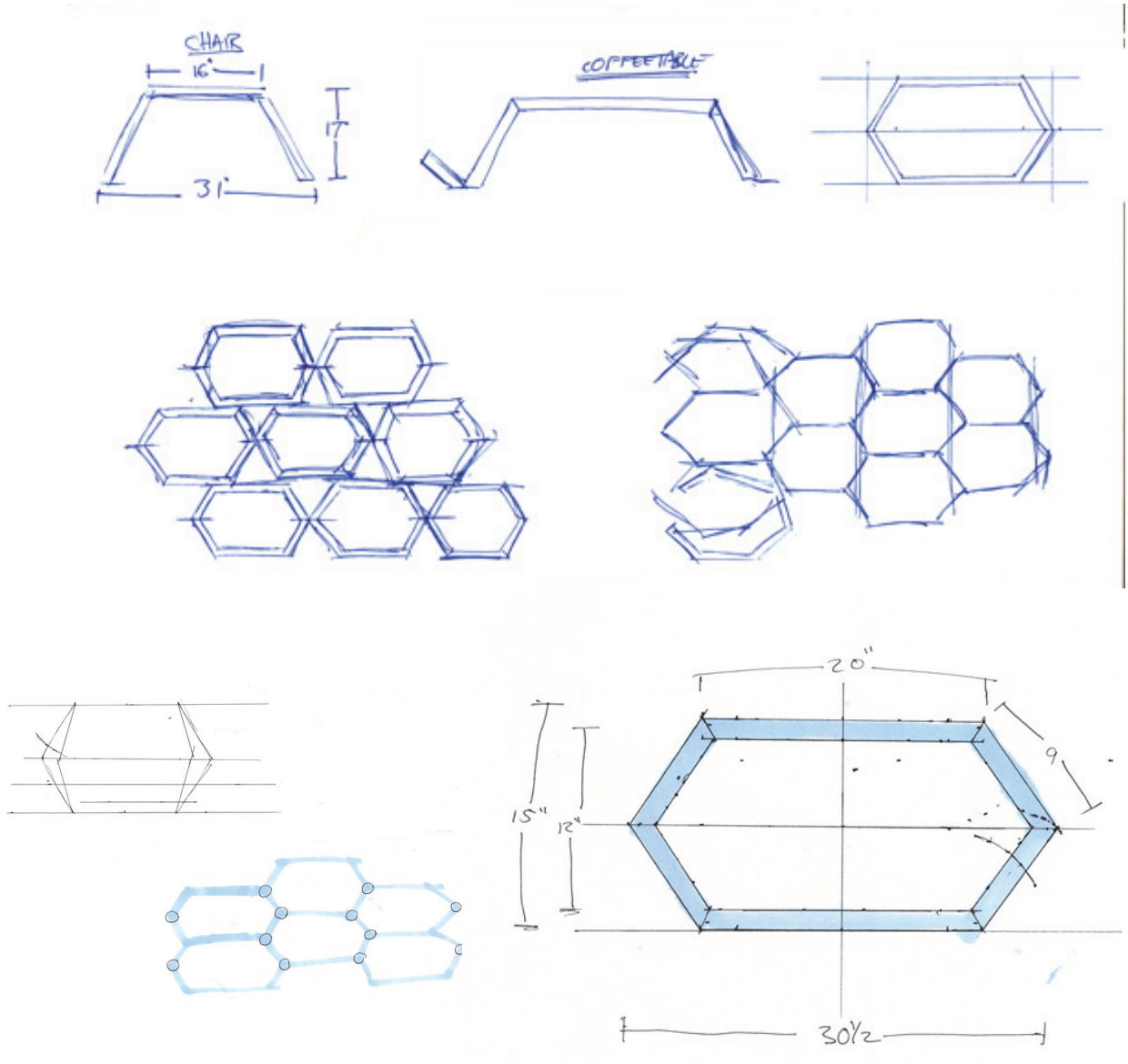
Ideation: Collapsible systems sketches

- Rotating units
- Collapsing
- Folding



Ideation: Collapsible modular system sketches

- Modular shelving
- Collapsible

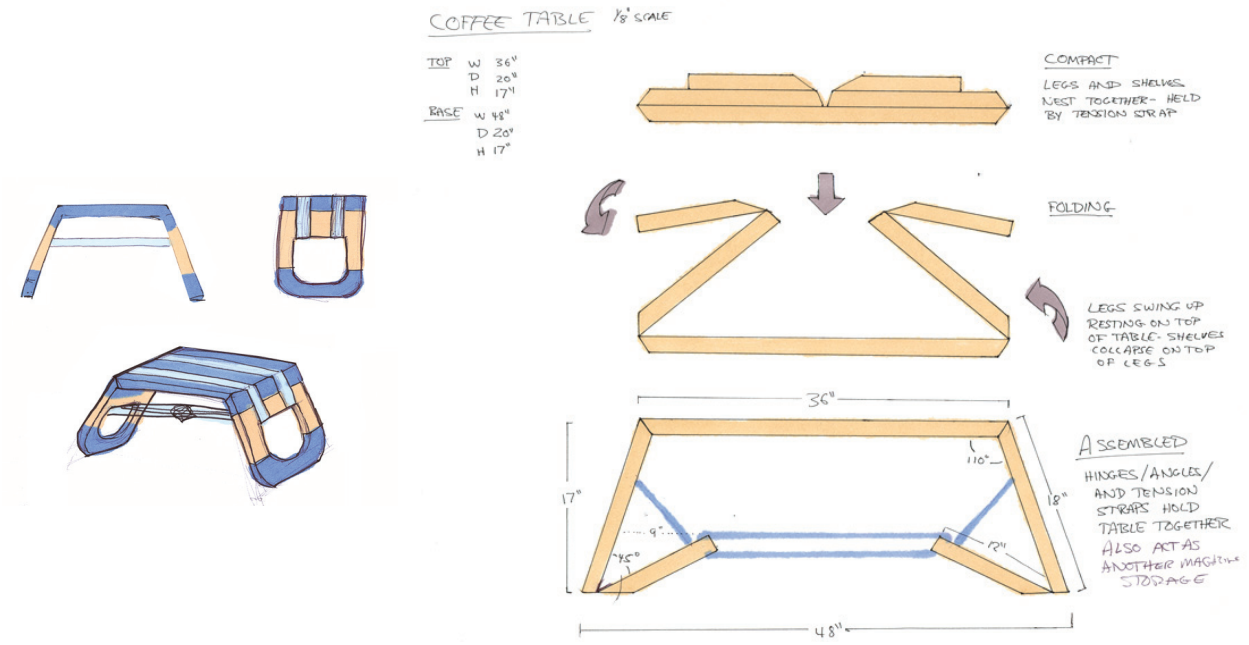


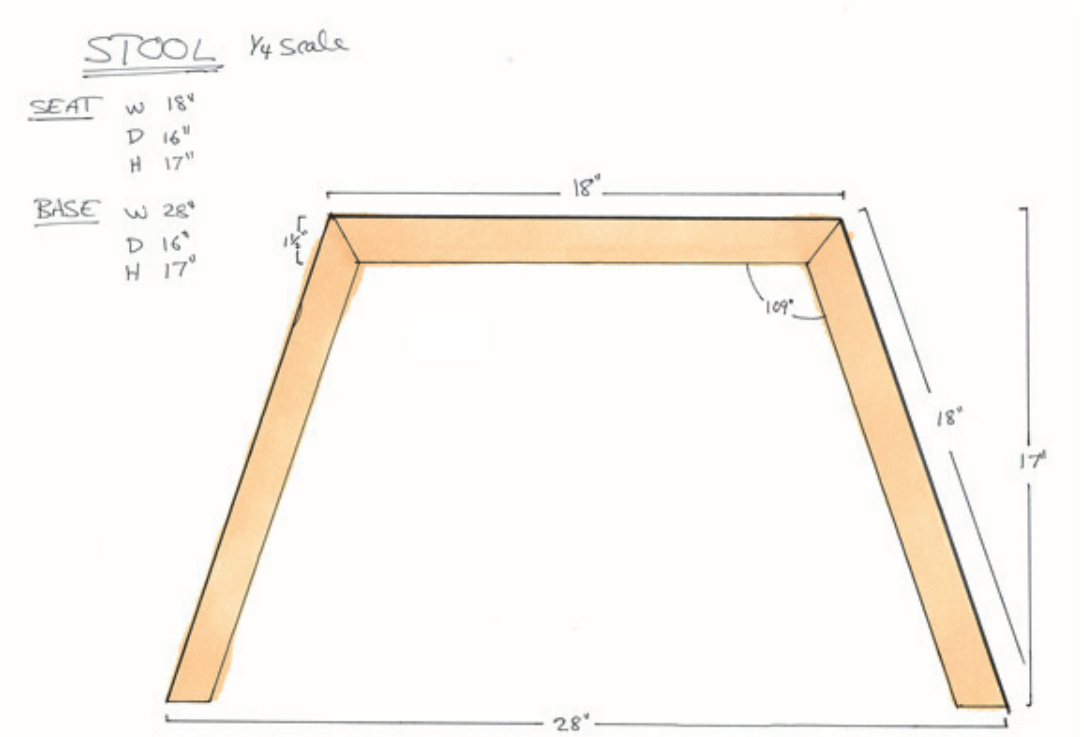
Ideation: Collapsible modular system mock-ups

- Multiple setup options
- Collapsible
- Connection points

Ideation: Tension structures sketches

- Exploration used moving system (tension straps) in creating moving furniture
- Collapsible
- Tension created structure





Ideation: Tension structures models

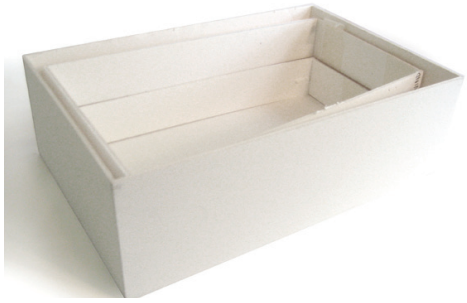
- Exploration using moving system (tension straps) in creating moving furniture
- Collapsible
- Tension creates structure

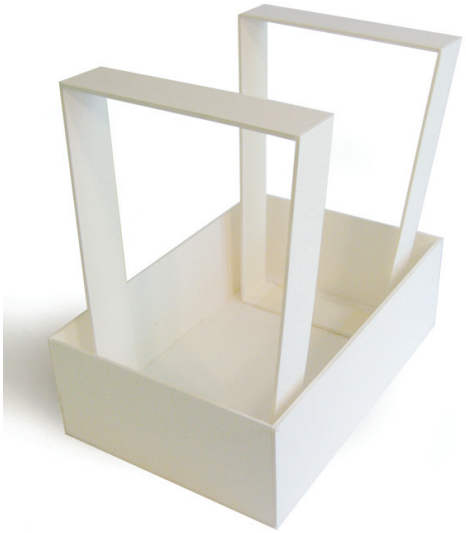
Ideation: Tension structure full scale model

- Full scale mock up clumsy
- Childlike
- Feels too transient

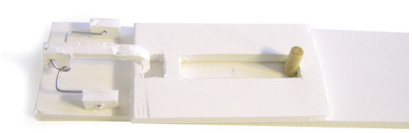
Ideation: Multi-use storage model

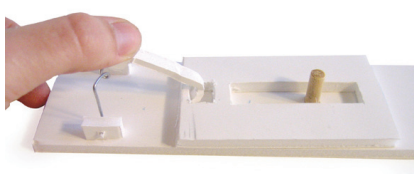
- Use of moving system in movable furniture (Hasp)
- Multi use bench/ storage box/ legs fit in box
- Tension created structure

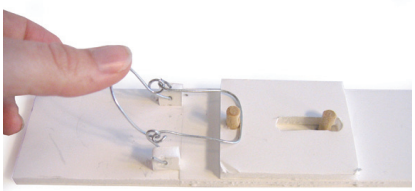




Custom hasp system explored







Preliminary Ideation Evaluation

Modular Collapsible System

- Collapsible
- Used moving device- tension strap held shape through tension
- Celebration of transience through tension strap

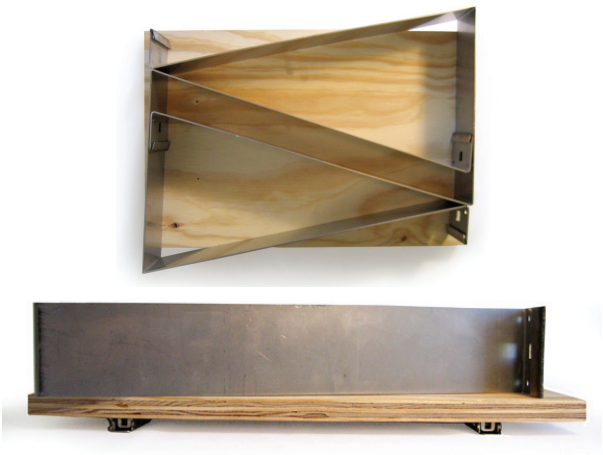
Multiuse Storage System

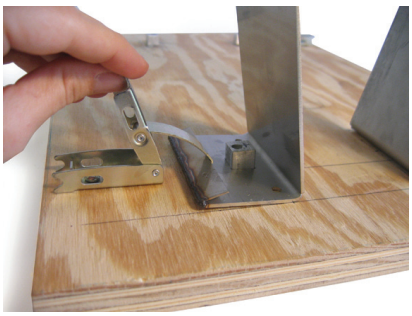
- Broke Down
- Seat transitioned into box for storage and moving
- Storage state also stored legs so no parts can be lost
- Used moving device, a hasp, for attaching legs to the seat through tension
- Celebration of transience through hasp

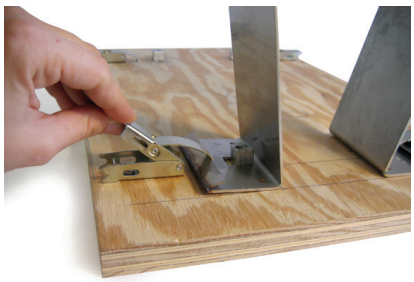
Ideation Focused

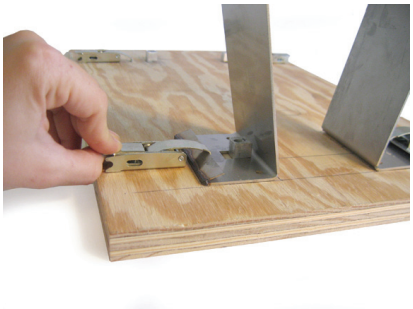
Exploration: Tension through integrated hasp system

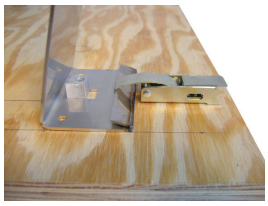
- Hasp and anchor block attached to bench
- Bent stainless steel legs fit over anchor block and folded lip attached via hasp

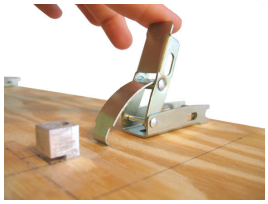






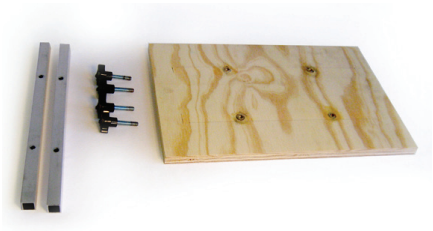
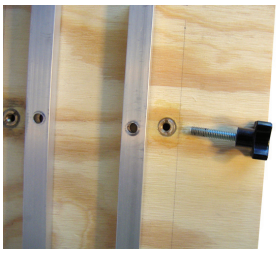
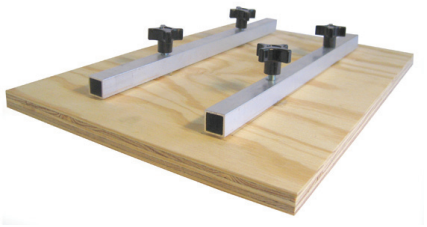
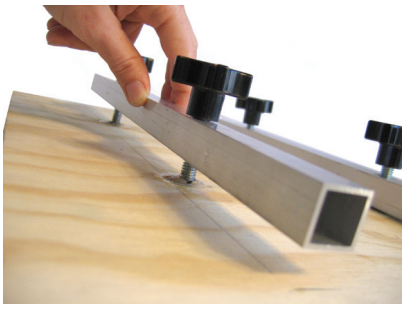
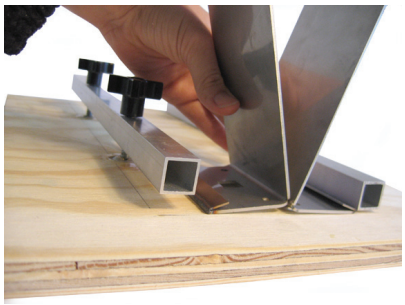
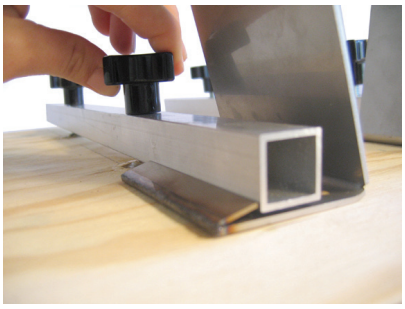


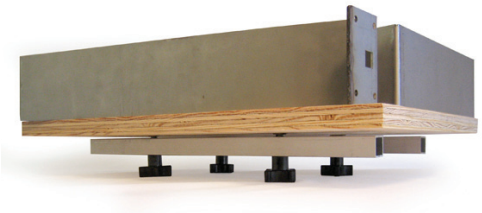




Exploration: Connection through thumbscrew system

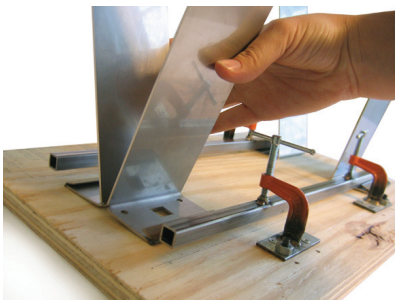
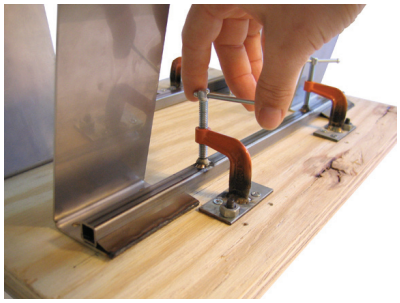
- Thumb screws acted as clamping mechanism

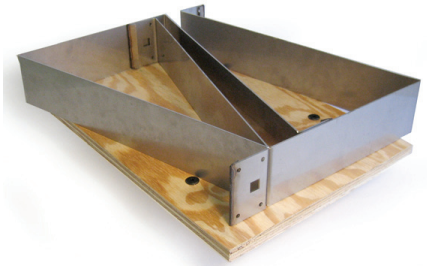



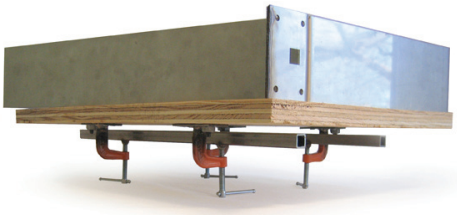

Exploration: Connection through clamp system

- One piece clamp system attached integrated square stock to clamp

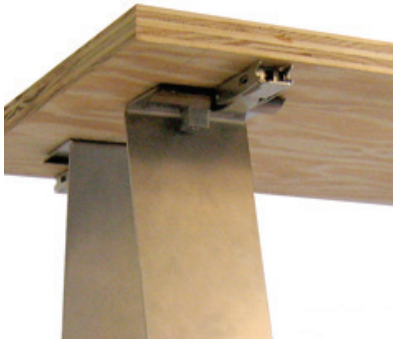










Ideation Focused Evaluation



Hasp Attachment

- Easy to assemble, disassemble
- Hardware attached in storage mode
- Ineffective in staying clasped, the flexibility needed to engage the legs also caused it to flex when in use and become unclasped
- Interesting use of tension and hardware

Thumbscrew Attachment

- Harder to assemble, disassemble
- Hardware not attached in storage mode
- Threaded inserts could not withstand torque, although more effective than hasps
- Design language more office than urban nomad

Clamp Attachment

- Easy to assemble, disassemble
- Hardware attached in storage mode
- Effective in staying clasped and structurally sound
- Celebrated urban nomad lifestyle through materials and hardware

These three concepts were explorations into using tension, hardware used for moving devices, and materials used in constructing a home. These forms all used the same steel legs and top and communicated their nomadic abilities through the application of hardware.

The C-clamp design effectively met the criteria laid out in the thesis refocused chapter.

1. Design a system that will allow an urban nomad to move from one location to another with ease
2. Showcase its mobile abilities
3. Enable the user to relocate efficiently through minimum hassle in packing, unpacking, and moving

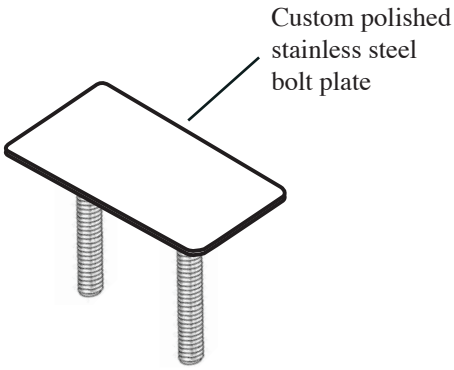
This solution broke down in a way that made relocating a simpler and more pleasant experience, it also gave the ability to proudly proclaim their nomadic lifestyle.

Implementation

Design Refined

The clamp design succeeded in addressing the needs of the refocused thesis statement.

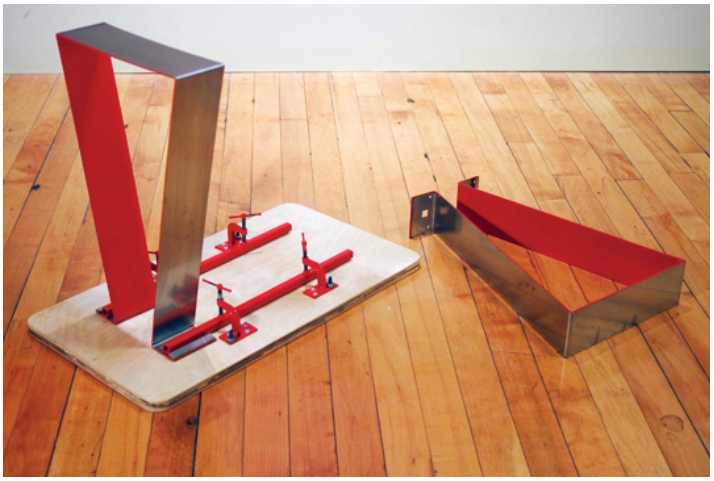
Design Refined: Custom elements



Finishing elements brought the design to completion. The material for the top of the bench was 3/4” varnished baltic birch plywood which was attached to the clamp system via a custom dual bolt

- Polished bolt plate is visible on top of stool- shape mimics top of stool
- Adds extra support for clamp system, tilting creates stress

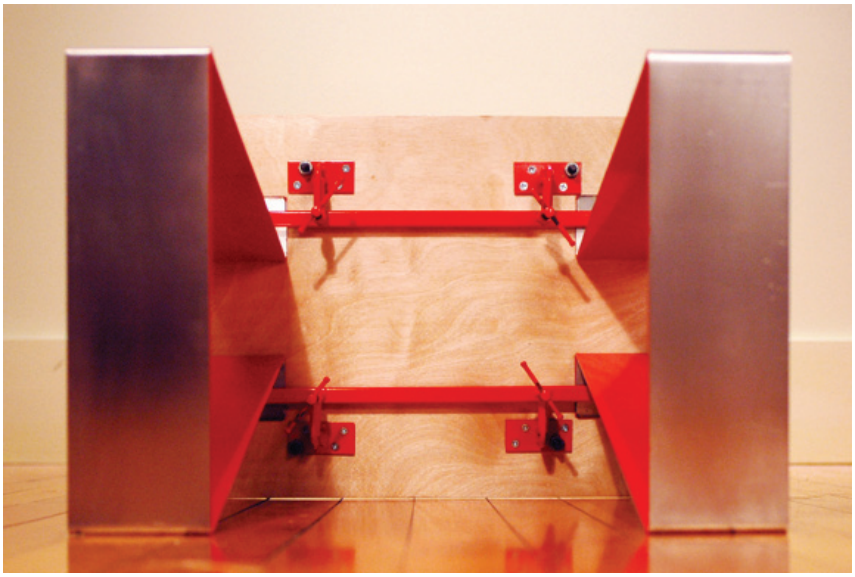
Design Refined: Finish



Powder coating on interior of stainless steel legs with polished exterior, color and texture matches clamp system.

- Showed there was an interesting element not readily visible
- Lead the viewers eye up the legs to see what was happening at the connection points
- Polished exterior showed the history of the furniture, thumbprints, scratches, every place that it has been will be apparent on the legs for a visual history

Design Refined: Clamp system

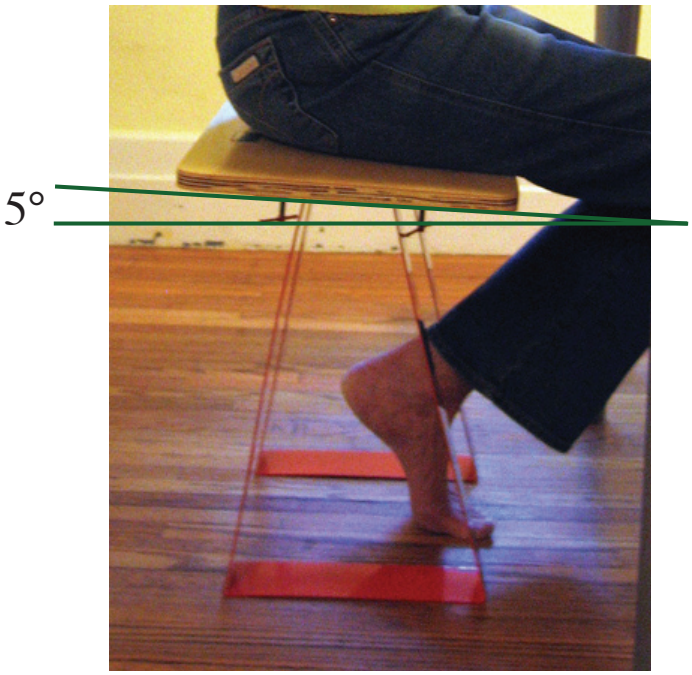


Clamp system is customized for manufacturing

- Traditional C-clamp form was used with a mounting plate added to the base
- Swivel Shoe at the base of the threaded screw was replaced with the square stock clamp bar running the length between the clamp frames
- Attachment was through punch pressing thread screw into the clamp bar, so clamp bar becames the swivel shoe
- Clamp was powder coated to make it a cohesive unit

Implementation

Design Expanded: Structure



In order for the design to meet the goals of this thesis project more fully the bench needed to be expanded into a furniture system through the creation of a dining and coffee table. The bench's flexibility is a benefit as it adds comfort for the user, but this flexible feature did not lend itself to tables which must have a rigid structure so items do not slide off it when pressure is applied.

Design Expanded: Legs

The design problem for the expanded systems was to create rigid legs for the coffee table and dining table. At first it seemed that the flexibility was where the steel had been bent, so gussets were added to the legs at the bend locations to add integrity of the structure. The addition of gussets alone did not remove the flex from the structure when pressure was added, the flat legs needed additional support. Two beads were added down the length of all flat areas of the legs, this created a fully structural table leg.

Gussets added to folds in leg

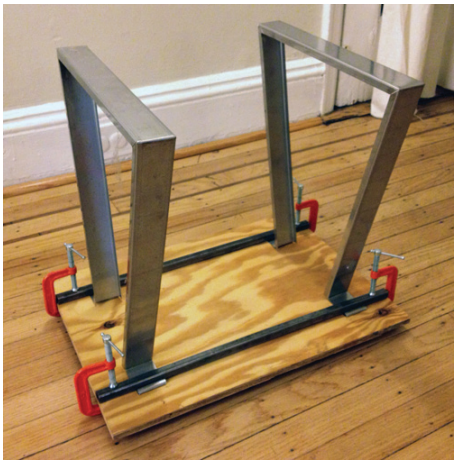
Beads added on length of legs

Beads and Gussets created structural table

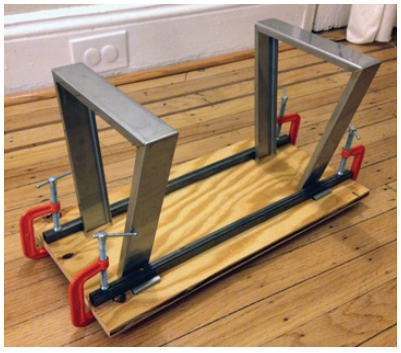
The bead and gusset solution was functional but was not consistent with the original bench solution. The design needed to be more direct and seamless, the addition of the beads and gussets together took too much attention away from the clamp system fastening the legs to the table top. The original legs were successful because the minimal design and the pop of color on the smooth interior drew the viewers eye upwards.

The final solution for the rigid table legs came by integrating the original manufacturing process of the legs. Flaps were added to the edges of the original leg template, these were bent at 90 degree angles running the length of the legs. When the bends were added to create the shape of the legs the flaps were welded together for a seamless gusset which also provided support for the length of the legs. This design has the same collapsible function as the original design and provides full stability while keeping aesthetic consistency.

1/2 scale dining and coffee table with final rigid leg design



1/2 scale dining table with final rigid leg design, top and bottom view



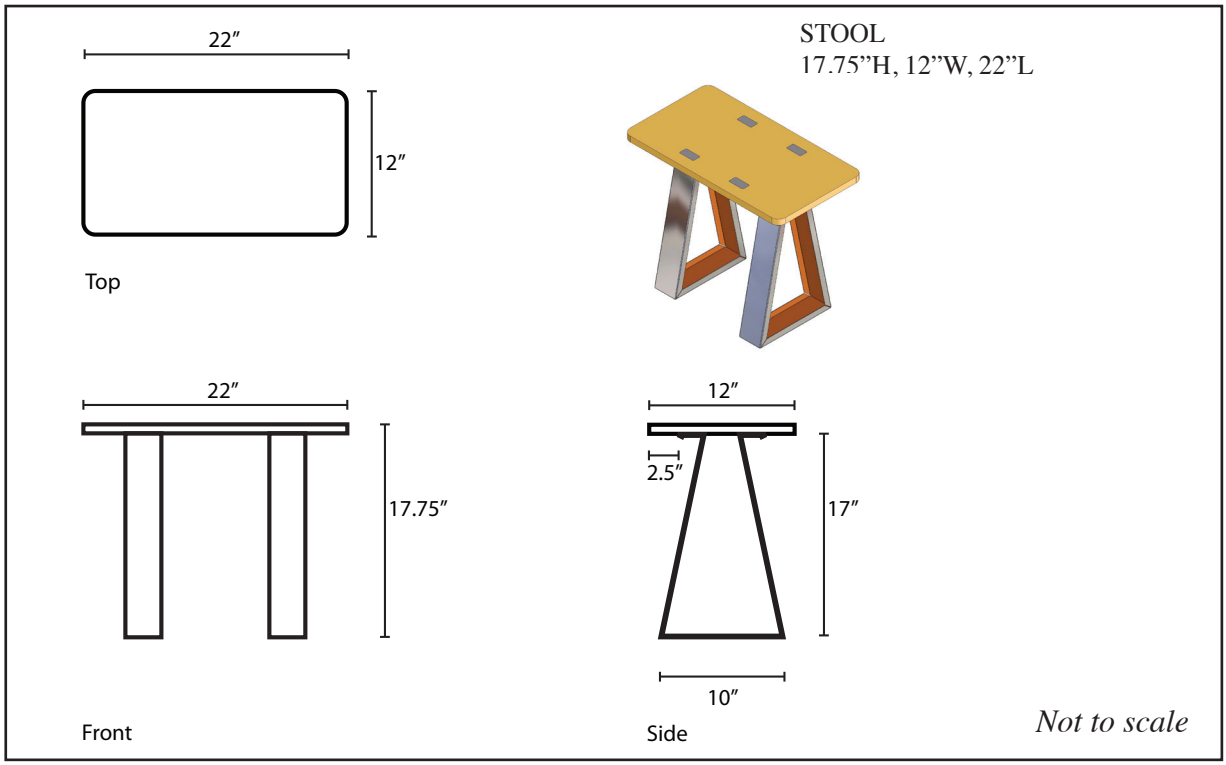
1/2 scale coffee table with final rigid leg design, top and bottom view

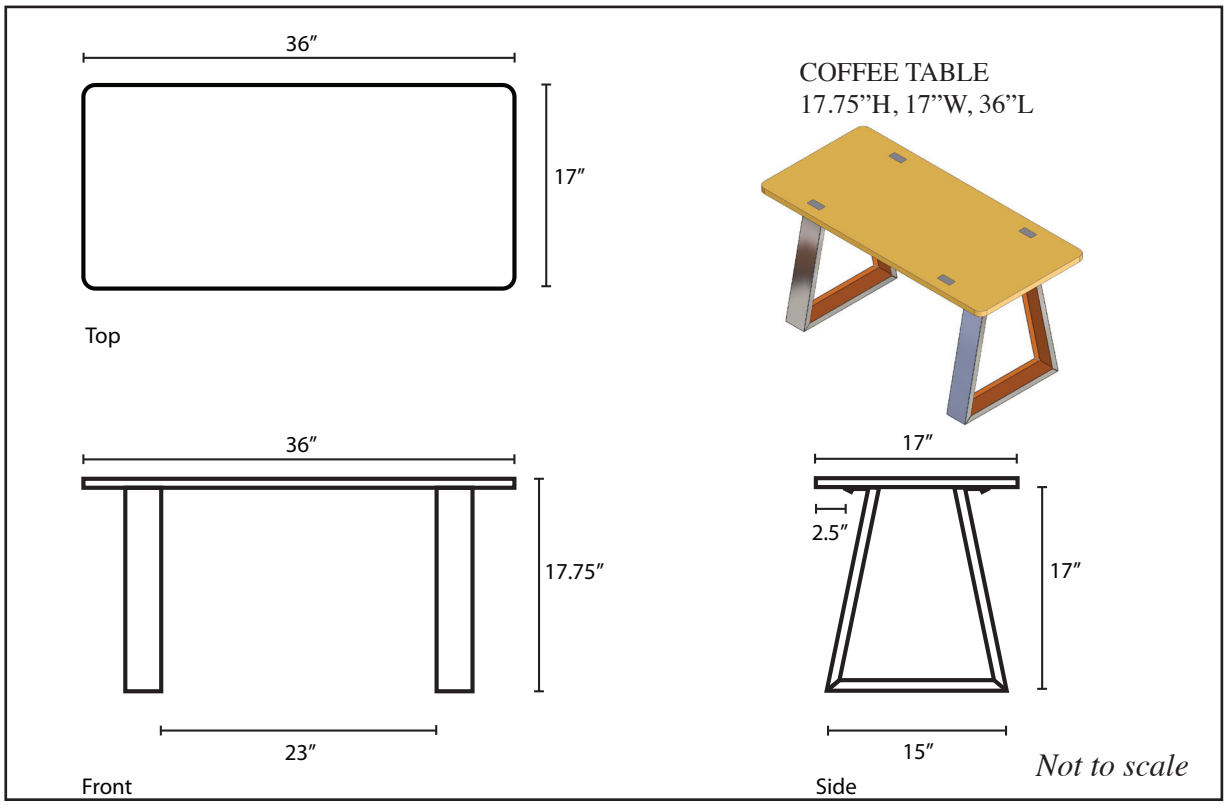
Design Expanded: Renderings and mockups

Stool, coffee table and dining table rendered

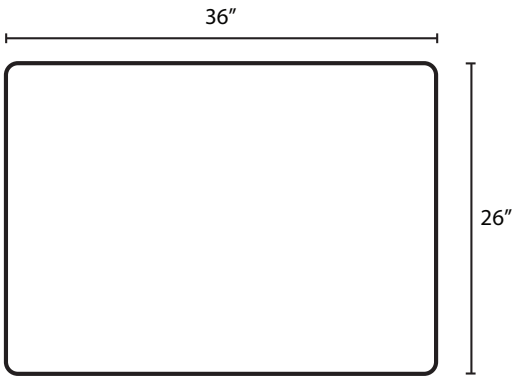
Full scale foam core mock ups of coffee table and dining table

Design Expanded: Stool and coffee table measurements

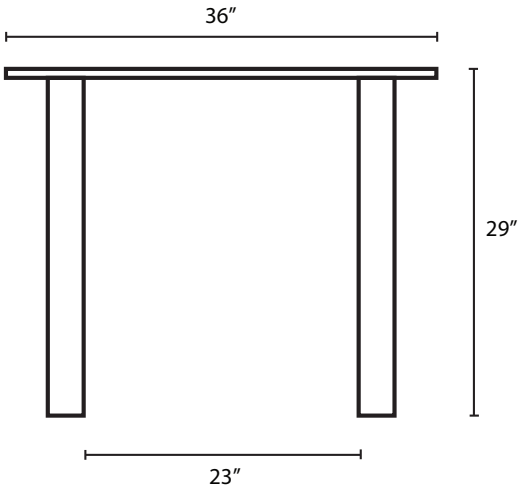




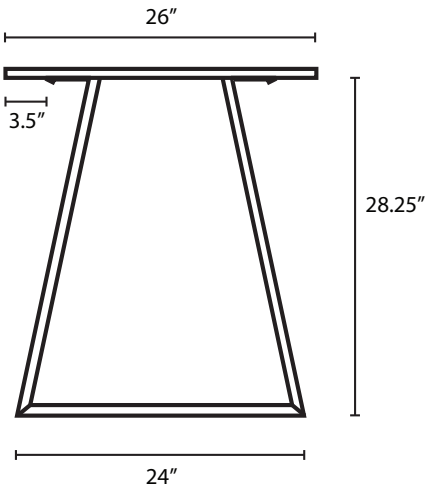
Design Expanded: Dining table measurements



Top



Front



Side

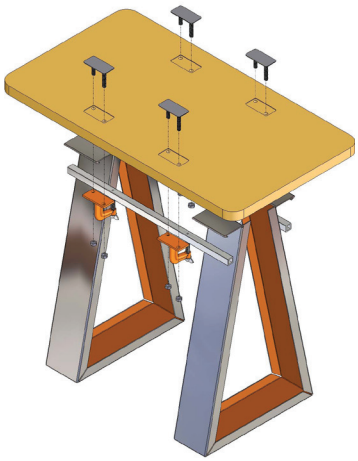
DINING TABLE
29″H 26″W 36L

Not to scale

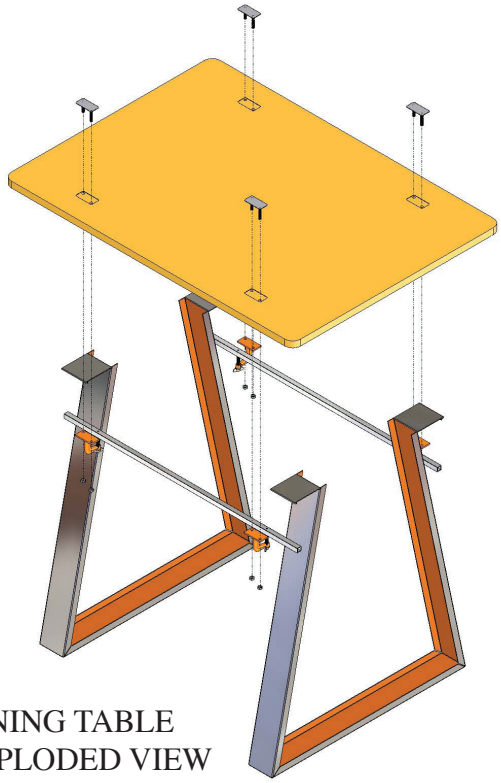
Implementation

Manufacturing

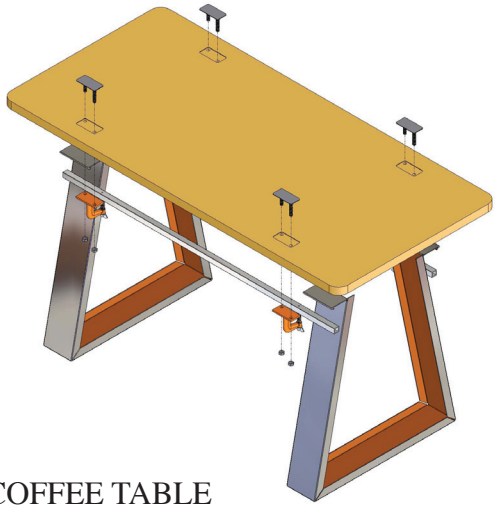
There are three main parts for each of the Cinch Furniture System pieces. Each piece consists of the stainless steel legs, the clamp system, and the baltic birch plywood top. Each of these parts require custom manufacturing.



STOOL EXPLODED VIEW



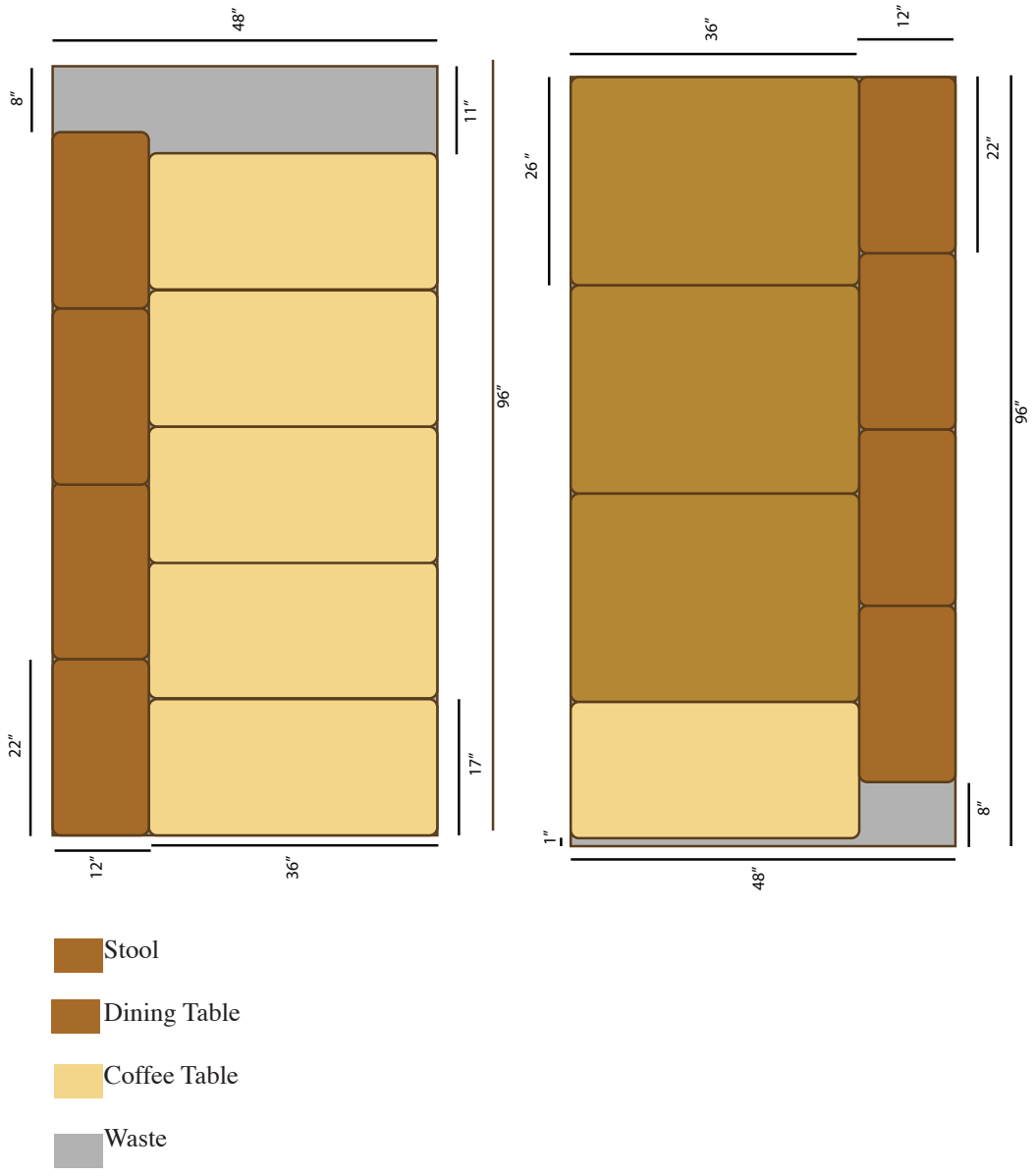
DINING TABLE EXPLODED VIEW



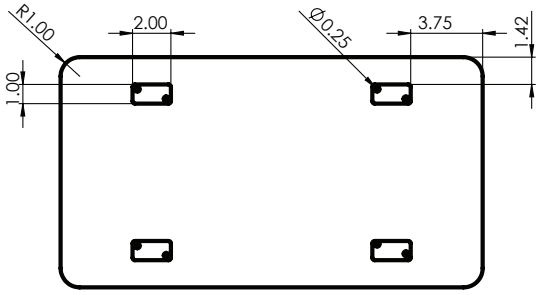
COFFEE TABLE EXPLODED VIEW

The process for manufacturing the baltic birch plywood top is as follows:

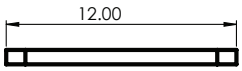
- Pieces are organized and drawn in an Auto CAD program
- Pieces are organized on (2) 96”x 46” sheets of 3/4” baltic birch plywood
- Two sheets will fit 8 stools, 6 coffee tables, and 3 dining tables
- Pieces are cut with a CNC router, including holes and recess for bolts
- The pieces are then coated with a polyurethane finish



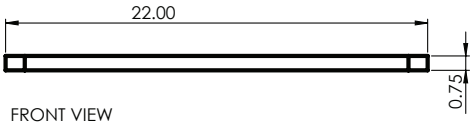
STOOL TOP
Not to scale



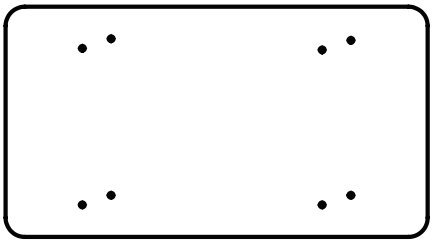
TOP VIEW



SIDE VIEW

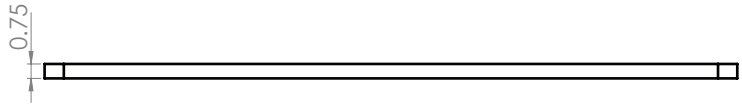


FRONT VIEW

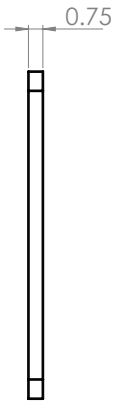


BOTTOM VIEW

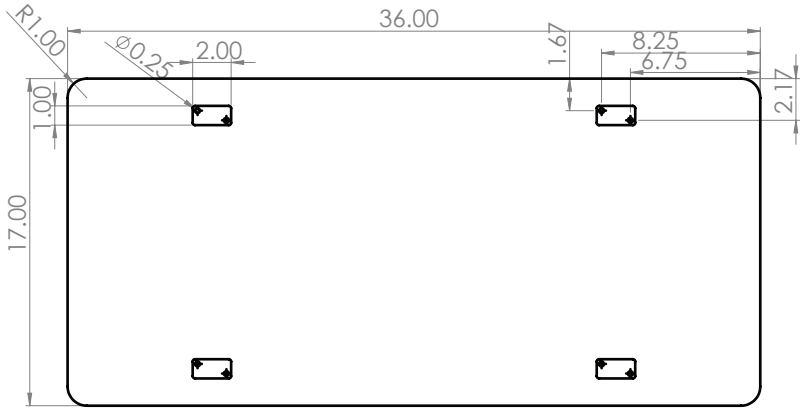
COFFEE TABLE TOP
Not to scale



FRONT VIEW

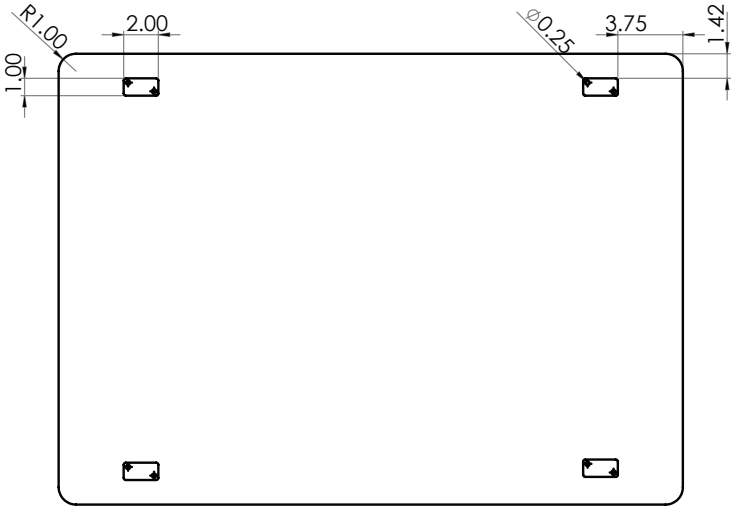


SIDE VIEW

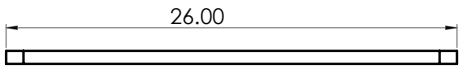


TOP VIEW

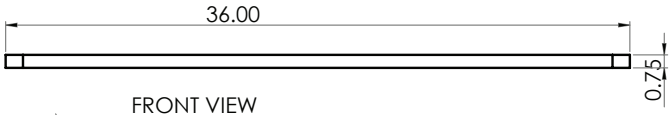
DINING TABLE TOP
Not to scale



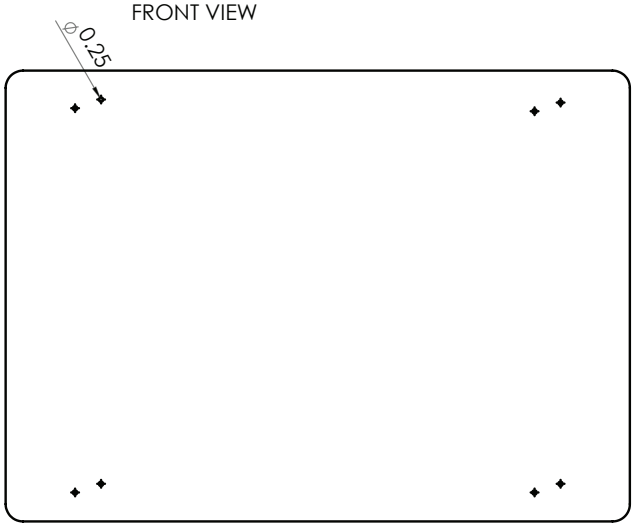
TOP VIEW



SIDE VIEW



FRONT VIEW



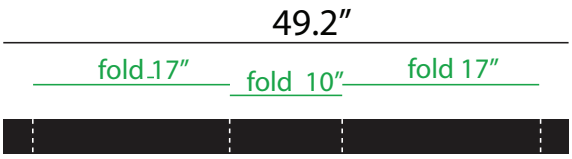
BOTTOM VIEW

The process for manufacturing the stainless steel legs is as follows:

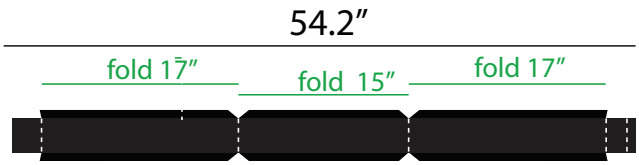
- They are drawn in an auto CAD program
- Stool legs are lazercut on a 4'x8' sheet of 14 gauge stainless steel
- The pieces are bent with box and pan folders
- The outside and edge surfaces of the legs are masked and the inside surface is powder coated red

Legs pattern

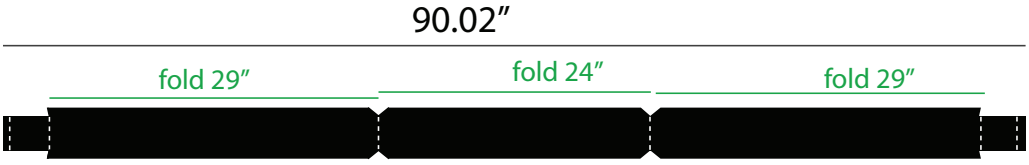
Stool Leg

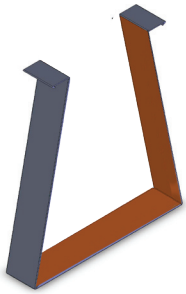


Coffee Table Leg

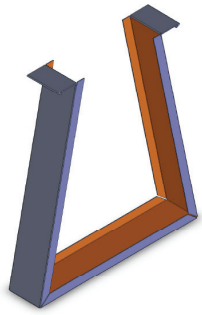


Dining Table Leg

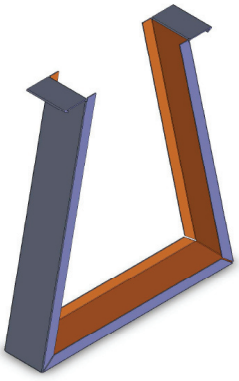




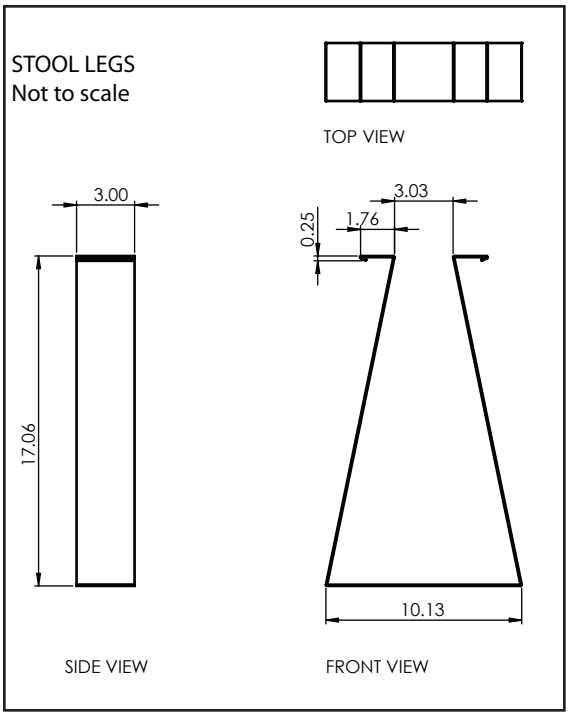
Stool leg Folded

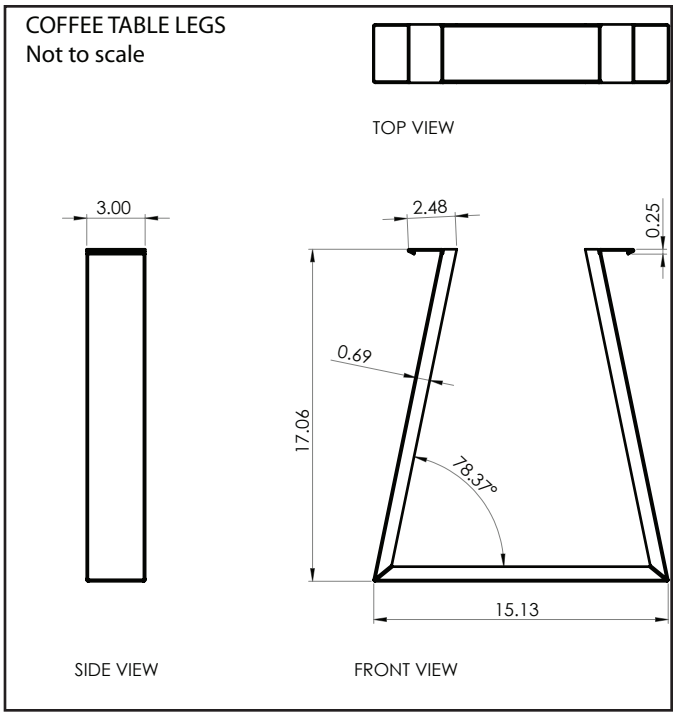


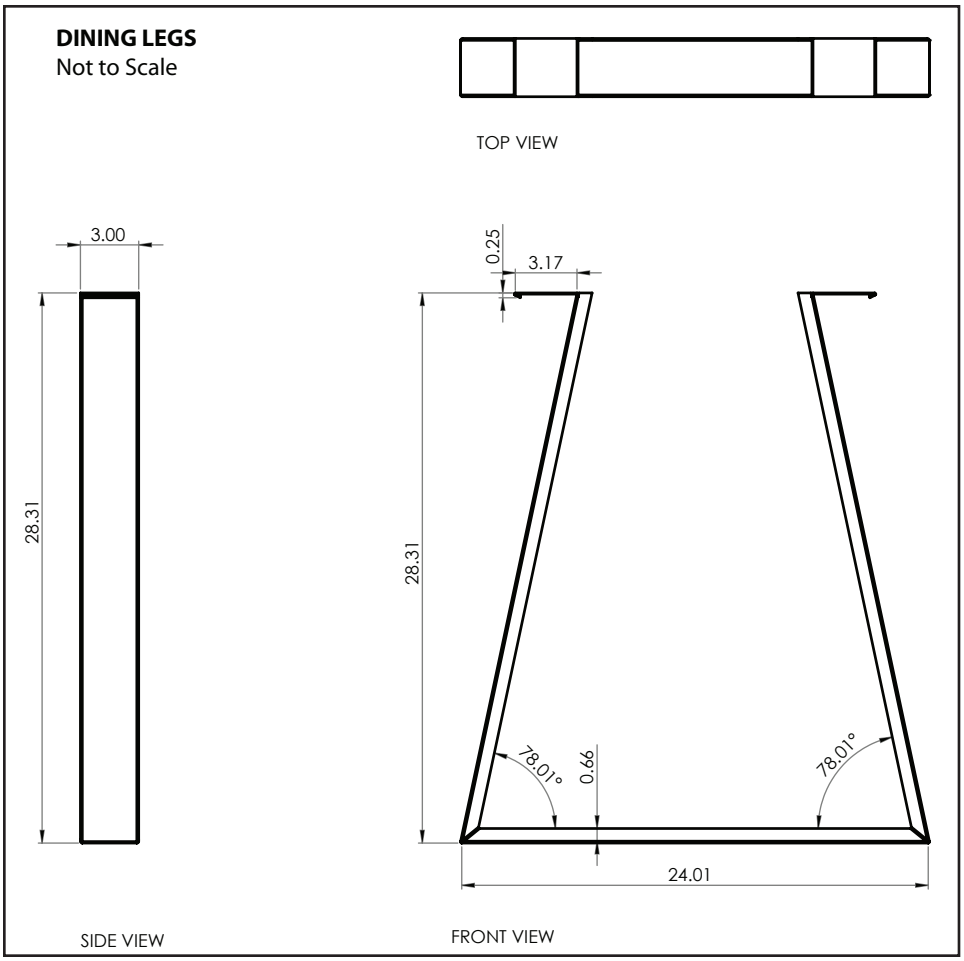
Coffee table leg Folded



Dining Table Leg Folded


STOOL LEGS
Not to scale
TOP VIEW
3.00
3.03
0.25
1.76
17.06
10.13
SIDE VIEW
FRONT VIEW

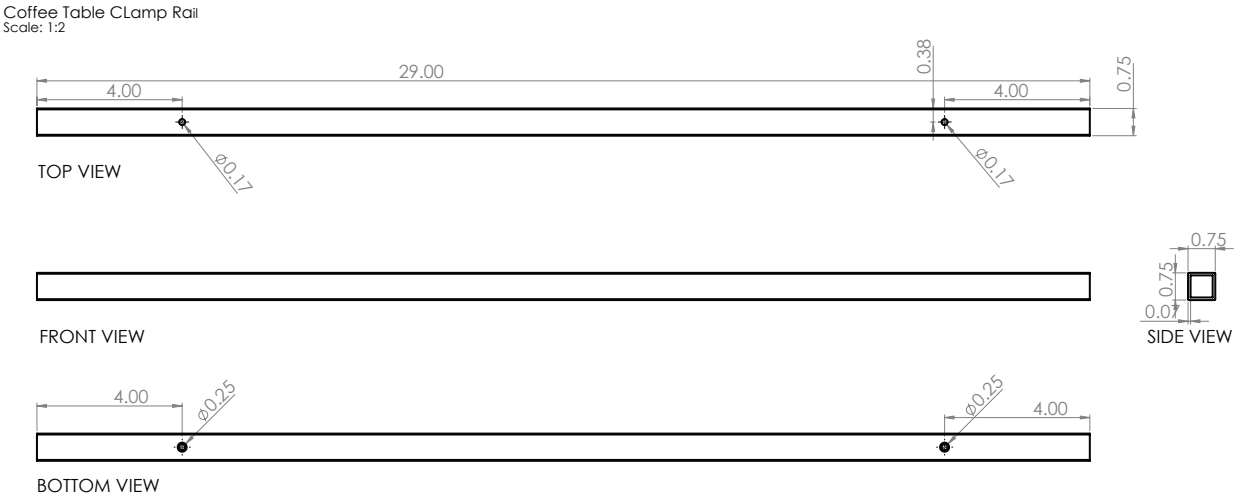

COFFEE TABLE LEGS
Not to scale
TOP VIEW
3.00
2.48
0.25
0.69
17.06
78.37°
15.13
SIDE VIEW
FRONT VIEW

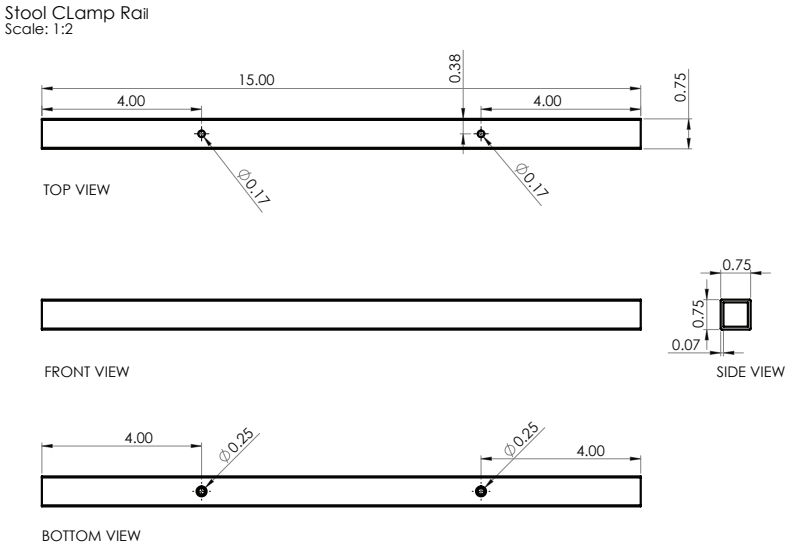

DINING LEGS
Not to Scale
TOP VIEW
3.00
0.25
3.17
28.31
28.31
78.01°
0.66
78.01°
24.01
SIDE VIEW
FRONT VIEW

The process for manufacturing the bar clamp is as follows:

- 3/4” Square steel stock will be cut to size with 1/6” holes pre-cut on one side and 1/4” holes pre-cut on other for attachment to clamp.
- Steel clamp body with mounting plate is forged in molten form from Solid works drawing
- Thread screw with swivel end sliding pin handle are attached to clamp body
- Clamp thread screw is machined down 1/4” from bottom of screw to 1/8” diameter.
- Machined down screw end is set in pre drilled holes in bar and flare pressed to attach the clamp to the bar while still being able to rotate the screw

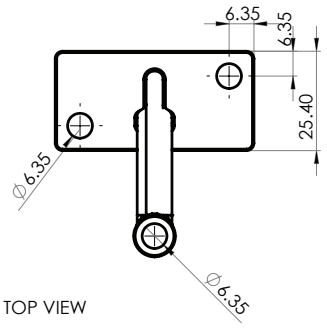
Dining and coffee table bar clamp specifications:



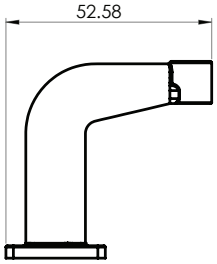


- Steel clamp body with mounting plate is forged in molten form from Solid works drawing
- Thread screw with swivel end sliding pin handle are attached to clamp body
- Clamp thread screw is machined down 1/4” from bottom of screw to 1/8” diameter.
- Machined down screw end is set in pre drilled holes in bar and flare pressed to attach the clamp to the bar while still being able to rotate the screw

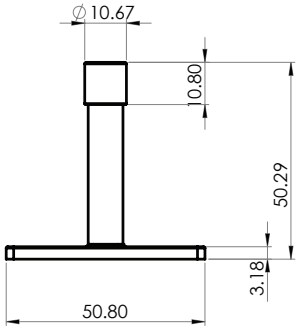
CLAMP BODY
Not to scale



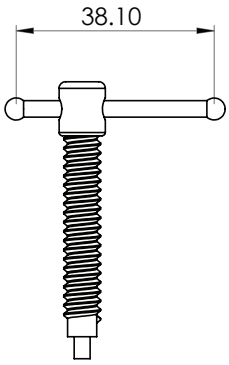
TOP VIEW



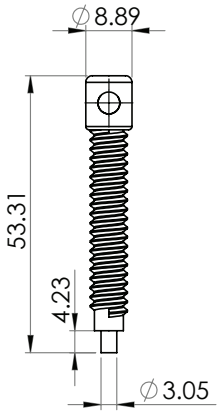
SIDE VIEW



FRONT VIEW

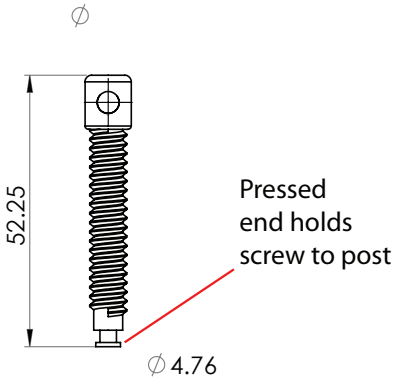


SIDE VIEW



FRONT VIEW

THREADED THUMB SCREW
PRE PRESS

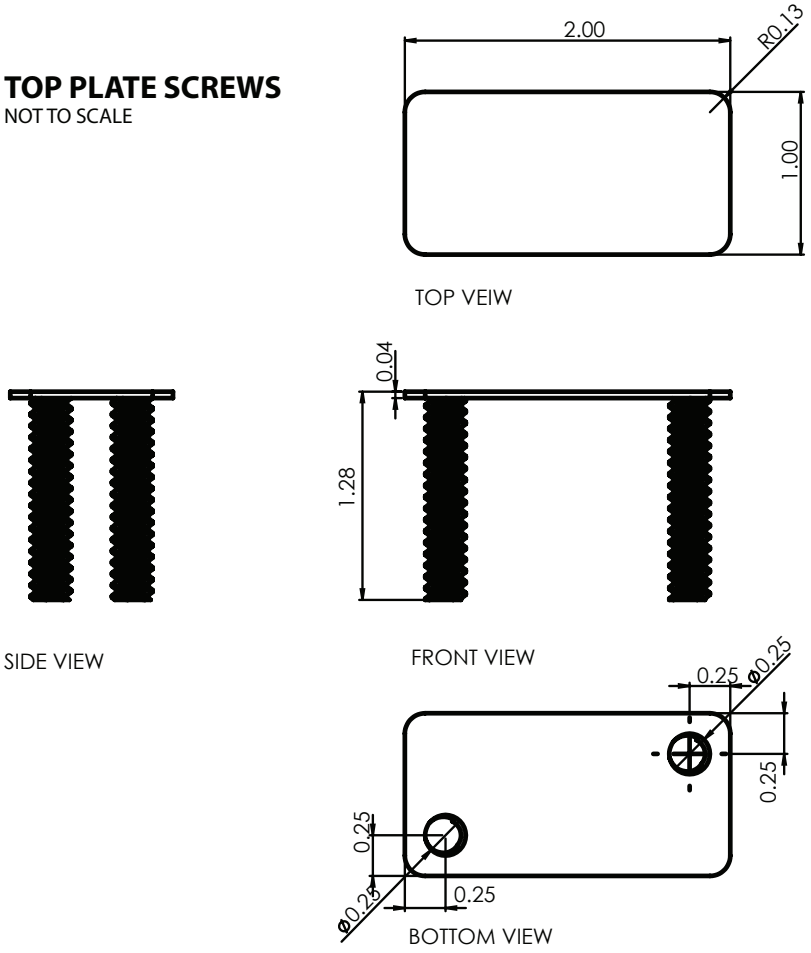


FRONT VIEW

THREADED THUMB SCREW
POST PRESS

The process for manufacturing the top plate screws attachment

- Die cut stainless steel plates
- 2 threaded posts contact welded using “spot facing”



Implementation

Ergonomics

This simple design is body friendly. The bench follows the standard bench height of 17”. This design is best for short term periods of seating. The 5°-15° tilt on the bench relieves lumbar pressure as it moves with the users body. The dining table is a standard height of 29” with a 23” wide leg clearance. The coffee table is a standard height of 17”.

The Cinch System’s compact form is easy and comfortable to carry

Bench weighs 11.5 lbs.

Coffee table weighs 17 lbs.

Dining table weighs 33 lbs.

Conclusion

The goal of this thesis will be to design a system that will allow an urban nomad to move from one location to another with ease. The system will showcase its mobile abilities and will enable the user to relocate efficiently through minimum hassle in packing, unpacking, and moving.

Because relocating ones possessions is time consuming and can be costly this thesis will focus on interior solutions rather than a mobile shelter system. This will maximize the users flexibility in finding appropriate existing shelter in whatever location they may be relocating to and will give them the ability to move their belongings with less hassle. (taken from Refocused Thesis Statement chapter)

The Cinch furniture system has successfully fulfilled the goals of this thesis statement, but maybe could be refined for ease of mobility. While the furniture system meets the stated goals allowing the user to efficiently build, deconstruct, or collapse the system, it's at rest profile may still allow for parts of the system to become misplaced.

The clamp system is innovative and is effective in showcasing its mobile nature. It allows the furniture to be broken down without having any fasteners to lose, as the clamp system is permanently attached to the table or stool top. The style and hardware embody the style and sensibilities of the user.

The system is innovative, breaks down easily, and showcases it's hardware, however, there could be issues during transportation as one unit, because the legs do not fully nest or lock in place when disassembled. This may allow the legs to slide around or give the opportunity for a leg to be misplaced if the unit is not bound together by secondary means.

The Cinch furniture system is a cost effective solution to furniture, which meets the furniture needs of young professionals who move often, but are proud of their transient nature and want to showcase their mobility without giving up style and comfort.

Works Cited

"Best in Cargo Capacity and Fuel Economy" ConsumerReports.org. Consumers Union of U.S., Inc., September 2012, Web, 8/10/2012. <http://www.consumerreports.org/cro/2012/01/best-in-cargo-capacity-and-fuel-economy/index.htm>

DeNavas-Walt, Carmen. Proctor, Bernadette D. Smith, Jessica C., "Income, Poverty, and Health Insurance Coverage in the United States: 2011 Current Population Reports." census.gov. U.S. Census Bureau, September 2012, PDF, 10/12/2012. <http://www.census.gov/prod/2012pubs/p60-243.pdf>

Kreider, Rose M. Elliot, Diana B. Census.gov. US Census Bureau. September 2009. PDF, pg 20-561. 09/16/2010 <http://www.census.gov/prod/2009pubs/p20-561.pdf>

Mollerup, Per. Collapsible: The Genius of Space-Saving Design, San Francisco: Chronicle Books Llc., 2002. Print.

"Moving Calculator." movesource.com. Movesource, 2009, web, April 2010. <http://www.movesource.com/movesourceweb/s/mc.aspx>

Oberg, Dr. Lalervo. "Culture Shock and the problem of Adjustment to the new cultural environments". World Wide Classroom Consortium for International Education & Multicultural studies. 29 Sept 2009.

Pedersen, Paul. The Five Stages of Culture Shock: Critical Incidents Around the World. cm. Contributions in psychology, no. 25. Westport, Conn: Greenwood Press, 1995. Print

Reiskin, Edward D., "San Francisco Transportation Fact Sheet, November 2011" SFMTA.com, San Francisco Municipal Transportation Agency, 29 November 2011, PDF, 9 April 2012. <www.sfmta.com/cms/rfact/documents/SFFactSheet201111-29-2011>

Taylor, Paul, et al. American Mobility Who Moves? Who Stays Put? Where's Home?. Pew Research Center, Released: December 17, 2008. Updated: December 29, 2008.

"Towing Capacity Chart." howstuffworks.org. HowStuffWorks, Inc., N.D. Web, 7/10/2008. <http://auto.howstuffworks.com/auto-parts/towing/towing-capacity/vehicle/towing-capacity-chart.htm>

Wright, Newell D. Claiborne, C.B.. Sirgy, M. Joseph, "The Effects of Product Symbolism on Consumer Self-Concept." Advances in Consumer Research Volume 19, (1992): 311-318. Print.